

Food & Nutrition Evaluation - Carbohydrate 1 -

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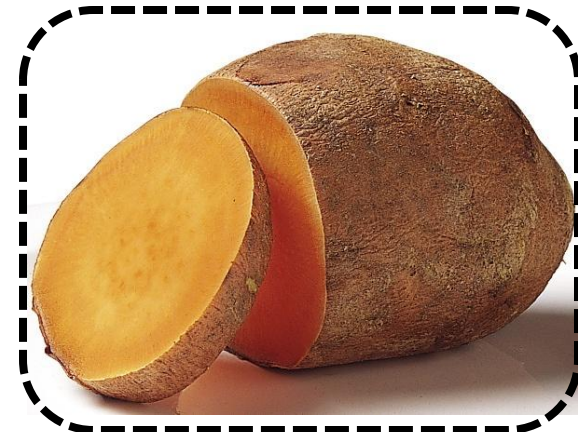




OUTLINE

MEETING I

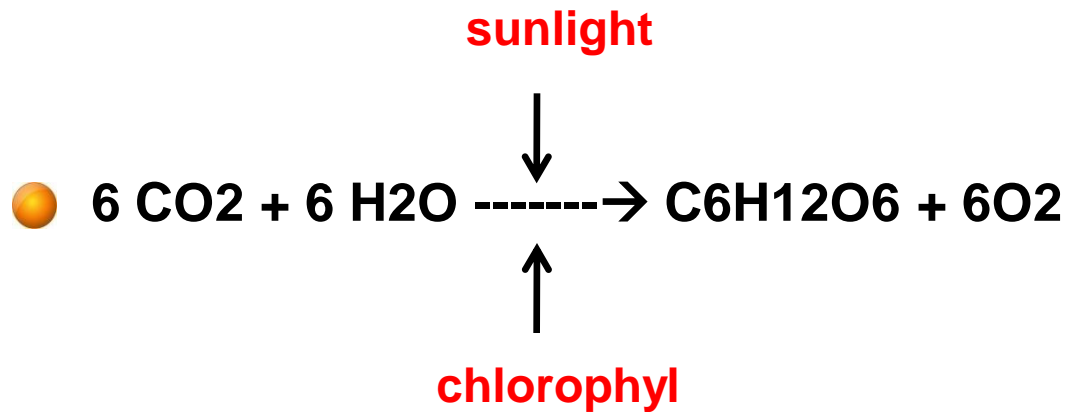
- **Carbohydrate synthesis**
- **Carbohydrate classification**
- **Role of Carbohydrate**
- **Carbohydrate digestion system**
- **Carbohydrate absorption**
- **Overview of carbohydrate metabolism**
- **Carbohydrate intake**



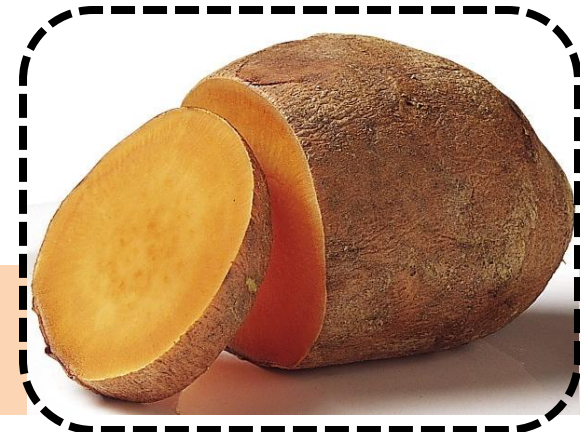


CARBOHYDRATE

PHOTOSYNTHESIS



● Polymerization → Starch and non-starch

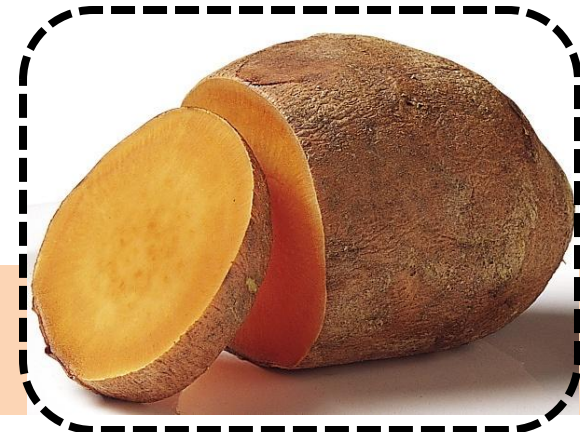




CARBOHYDRATE

CLASSIFICATION

- **Monosaccharides : glucose, fructose, galactose**
- **Disaccharides : sucrose, maltose, lactose**
- **Oligosaccharides : Maltodextrin , raffinose, stachyose**
- **Polysaccharides : starch, dextrin, glycogen and cellulose**

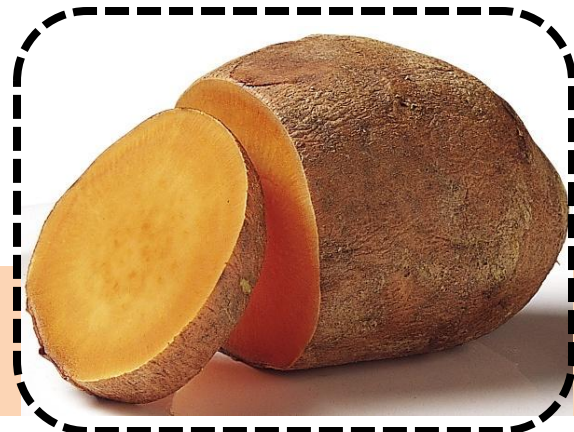




CARBOHYDRATE

CARBOHYDRATE SOURCE

- **Cereal grains** : wheat, barley, rice, millet, buckwheat and oats.
- **Starchy vegetable** : beets, carrots, cauliflower
- **Legumes** : peanuts, peas and beans.
- **Fruit** : banana, apple, apricot, guava

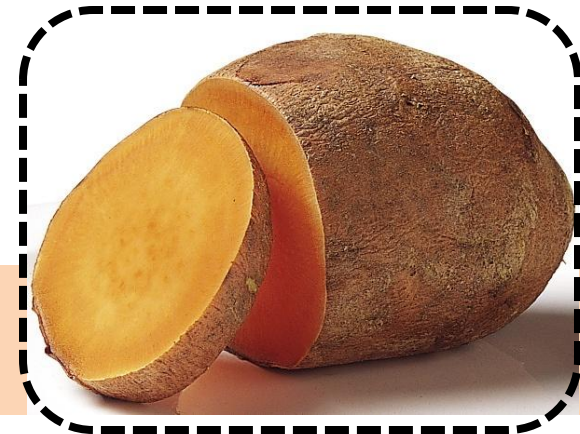




CARBOHYDRATE

ROLE OF CARBOHYDRATE

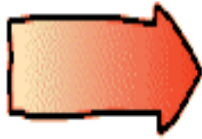
- **Energy source**
- **Fuel for the Central Nervous System**
- **Fuel for the Muscular System**
- **Supposedly Spare Proteins**
- **Supposedly Supply Dietary Fiber**





DIGESTION

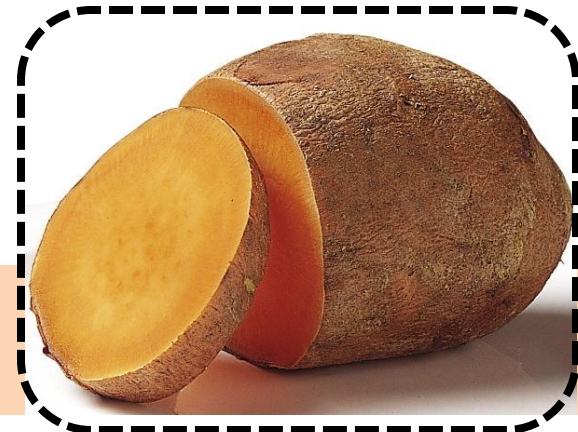
DIGESTION



breakdown of nutrients into their simple forms



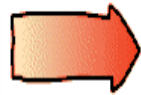
Easy to be absorbed !!





DIGESTION

MOUTH

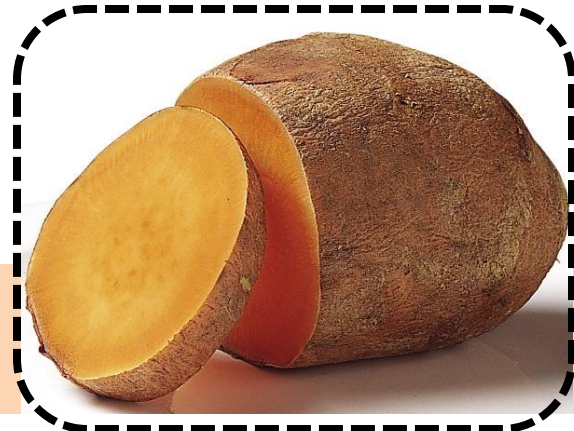


Salivary Carbohydrate Digestion



- **Mechanical digestion: the act of chewing**
- **Chemical digestion: enzymes breaking down starches**

Enzyme salivary α -amylase \rightarrow 1,4 α -glycosidic amylose & amylopectin \rightarrow dextrin



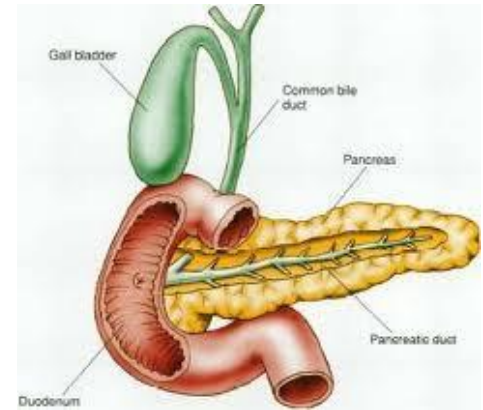


DIGESTION

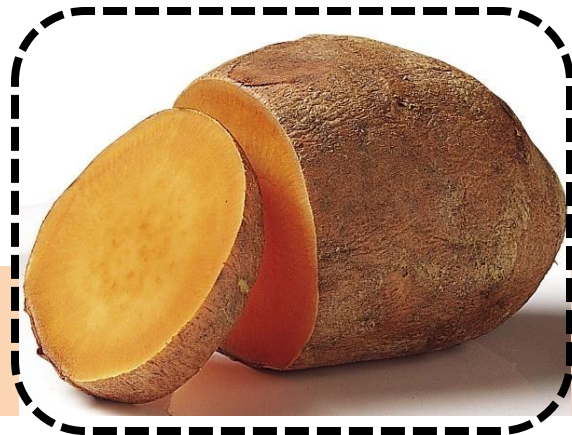
PANCREAS

Pancreatic α -amylase \rightarrow 1,4 glycosidic \rightarrow dextrin \rightarrow maltose

- Produces monosaccharides, disaccharides, and polysaccharides
- Major importance in hydrolyzing starch and glycogen to maltose



Polysaccharides $\xrightarrow{\text{Amylase}}$ Disaccharides

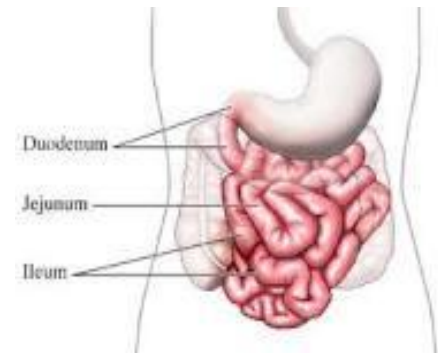




DIGESTION

SMALL INTESTINE

Digestion mediated by enzymes synthesized by cells lining the small intestine (*brush border*)

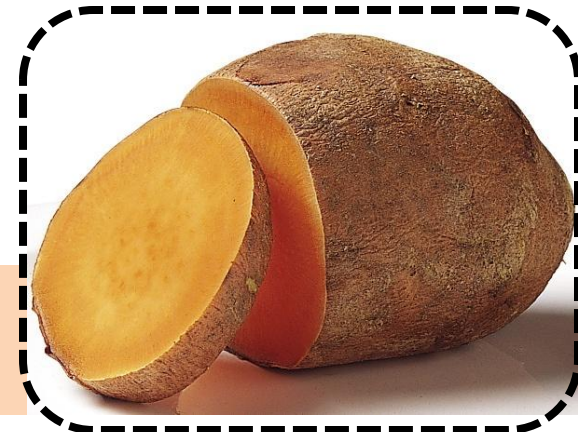


Disaccharides ^{*Brush Border Enzymes*} \longrightarrow **Monosaccharides**



sucrase, isomaltase and lactase

*** Exception is β -1,4 bonds in cellulose**



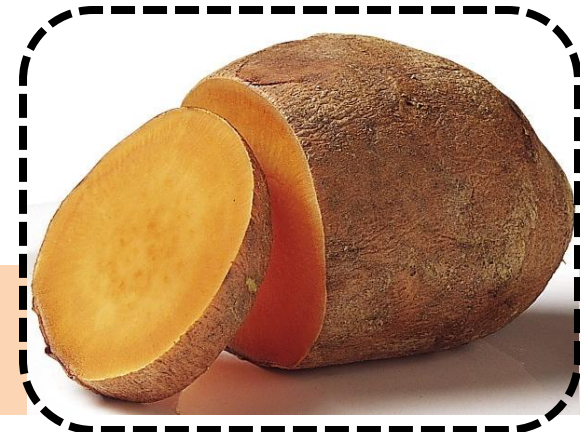


DIGESTION

Sucrose $\xrightarrow{\text{Sucrase}}$ 1 mol Glucose + 1 mol Fructose

Maltose $\xrightarrow{\text{Maltase}}$ 2 mol Glucose

Lactose $\xrightarrow{\text{Lactase}}$ 1 mol Glucose + 1 mol Galactose





OVERVIEW

<u>Location</u>	<u>Enzymes</u>	<u>Form of Dietary CHO</u>
Mouth	Salivary Amylase	Starch Maltose Sucrose Lactose
Stomach	(amylase from saliva)	<div> <div>↓</div> Dextrin→Maltose </div>
Small Intestine	Pancreatic Amylase	<div> <div>↓</div> Maltose </div>
	Brush Border Enzymes	<div> <div> <div>↓</div> Glucose + Glucose </div> <div> <div>↓</div> Fructose + Glucose </div> <div> <div>↓</div> Galactose + Glucose </div> </div>
Large Intestine	None	Bacterial Microflora Ferment Cellulose



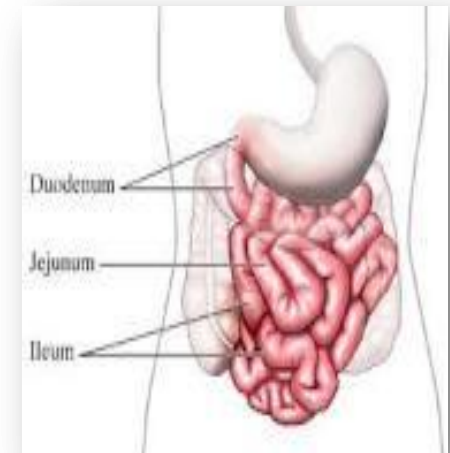
ABSORPTION

SMALL INTESTINE

Monosaccharides (glucose, fructose, galactose)

Absorbed through epitel cell of small intestine

Transported by blood circulation system via portal vein



Conc. Monosaccharide $>>$ \longrightarrow Passive transport or facilitative

Conc. Monosaccharide $<<$ \longrightarrow Active transport

Glucose and galactose \rightarrow absorbed faster



ABSORPTION

LARGE INTESTINE



The large intestine absorbs water from the bolus and stores feces until it can be egested



allow fermentation due to the action of gut bacteria, which breaks down some of the substances that remain after processing in the small intestine



In humans, these include most complex saccharides (at most three disaccharides are digestible in humans).





Animation

Carbohydrate Digestion Animation





METABOLISM

Insulin, epinephrine, glucagon

If glucose conc.in blood too high

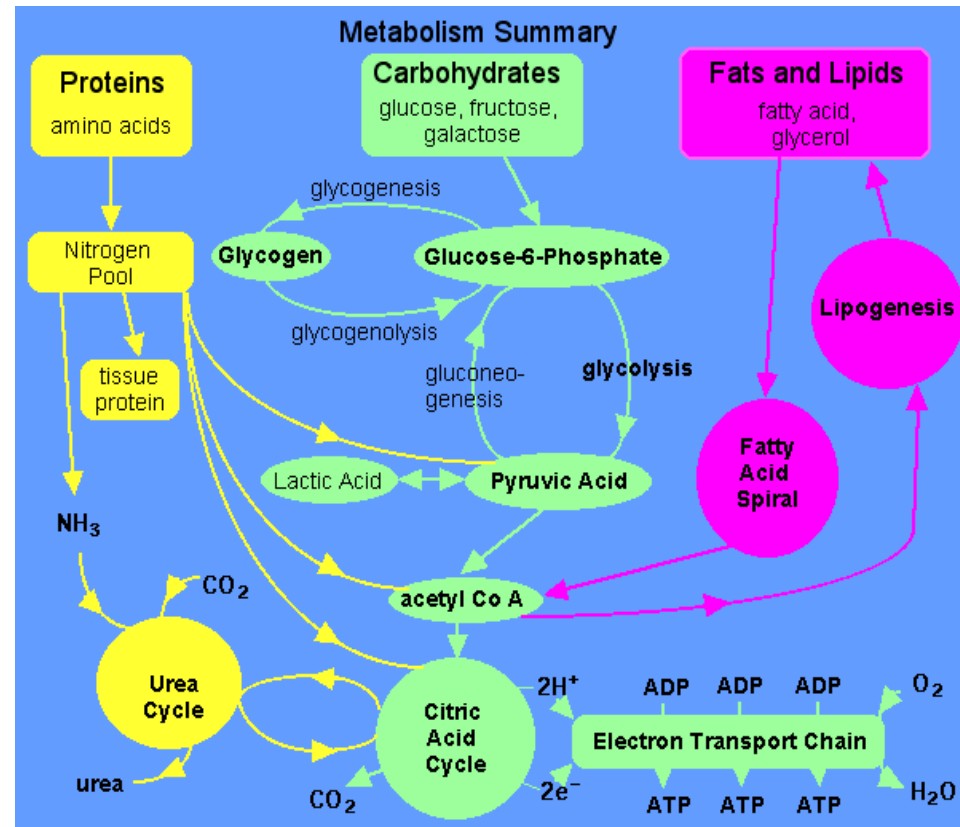
Insulin is secreted by the pancreas

glucose → glycogen (glycogenesis)

If glucose conc.in blood too low

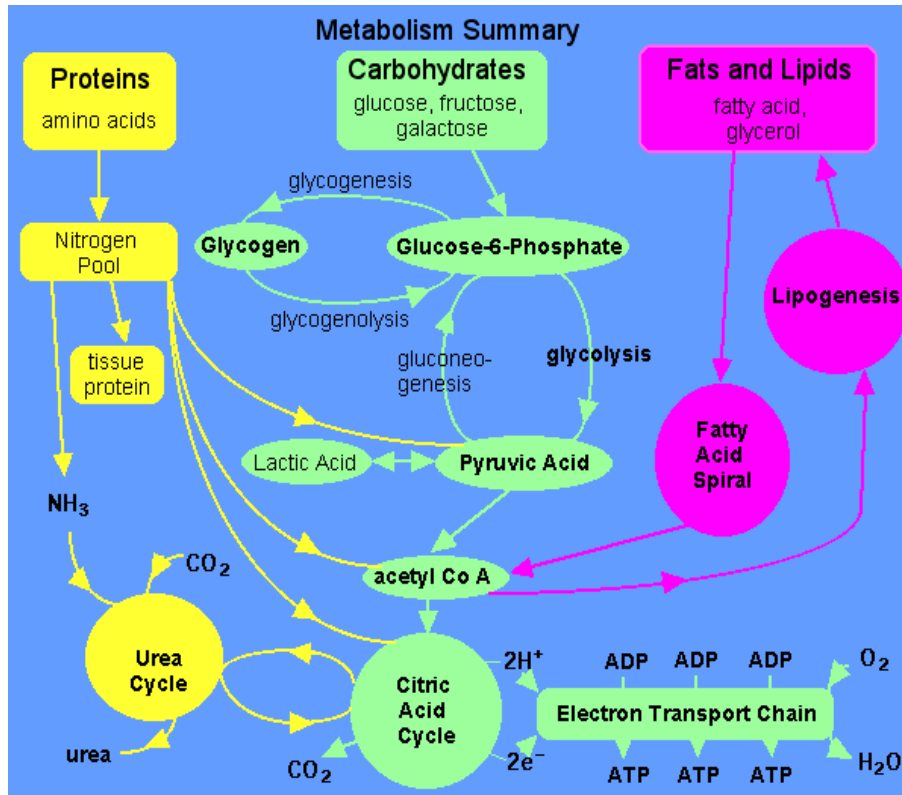
Epinephrine and glucagon are secreted by the pancreas

Glycogen → glucose (glycogenolysis)





METABOLISM



If glucose is needed to supply energy
glucose → pyruvate acid + ATP (glycolysis)

pyruvic acid → acetyl CoA → citric acid (TCA cycle)

During strenuous muscular activity:

pyruvate acid → lactic acid

During resting period:

lactic acid → pyruvate acid → glucose (gluconeogenesis)



INTAKE

SIMPLE CARBOHYDRATE

- simple sugars and are chemically made of one or two sugars
- break down quickly into glucose
- certain simple carbohydrates can cause such a quick rush of insulin that they actually increase appetite and the risk of excess fat storage
- candy, table sugar, syrups, and soft drinks





INTAKE

COMPLEX CARBOHYDRATE

- known as starches
- made of three or more linked sugars , break down slower and burn as energy longer. They are in general less fattening
- Grains such as bread, pasta, oatmeal and rice , some vegetables like broccoli, corn legumes They take the longest to digest.





INTAKE

FIBER ??????

- Carbohydrate in plants → fruits, vegetables and grains
- Can't be digested !!!
- Important part of a healthy diet